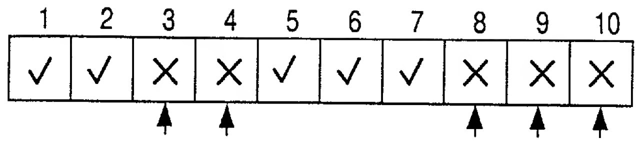


√ = PACKETS RECEIVED

X = PACKETS NOT RECEIVED

FIGURE 1

APPLICATION SEND THREAD

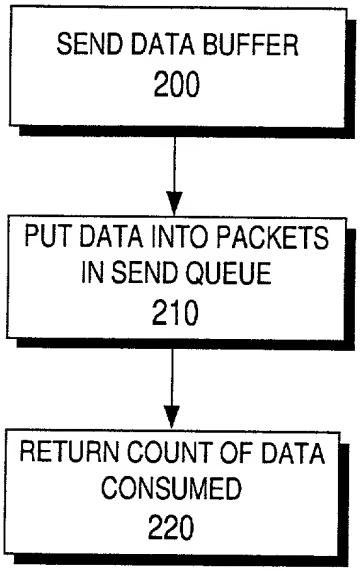


FIGURE 2A

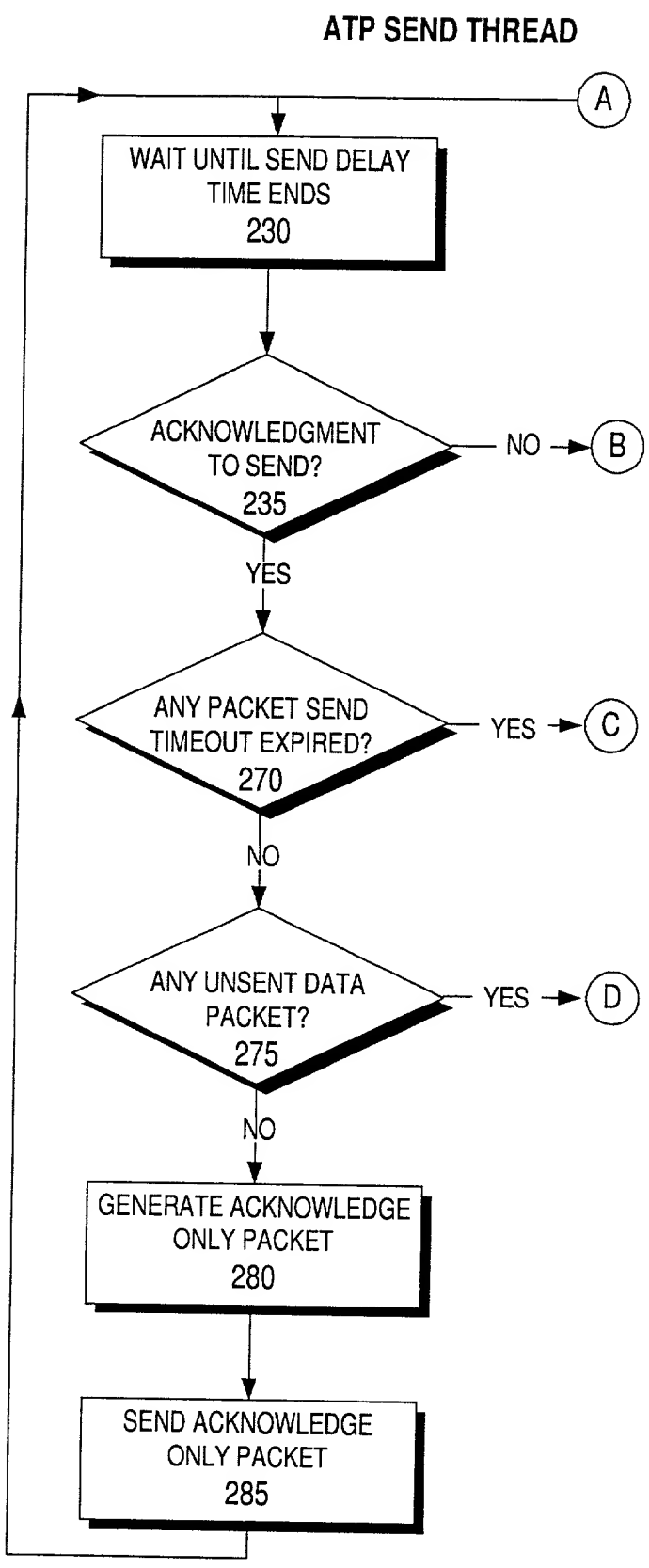

ATP SEND THREAD
A
WAIT UNTIL SEND DELAY TIME ENDS
230
ACKNOWLEDGMENT TO SEND?
235
NO
B
YES
ANY PACKET SEND TIMEOUT EXPIRED?
270
YES
C
NO
ANY UNSENT DATA PACKET?
275
YES
D
NO
GENERATE ACKNOWLEDGE ONLY PACKET
280
SEND ACKNOWLEDGE ONLY PACKET
285

FIGURE 2B

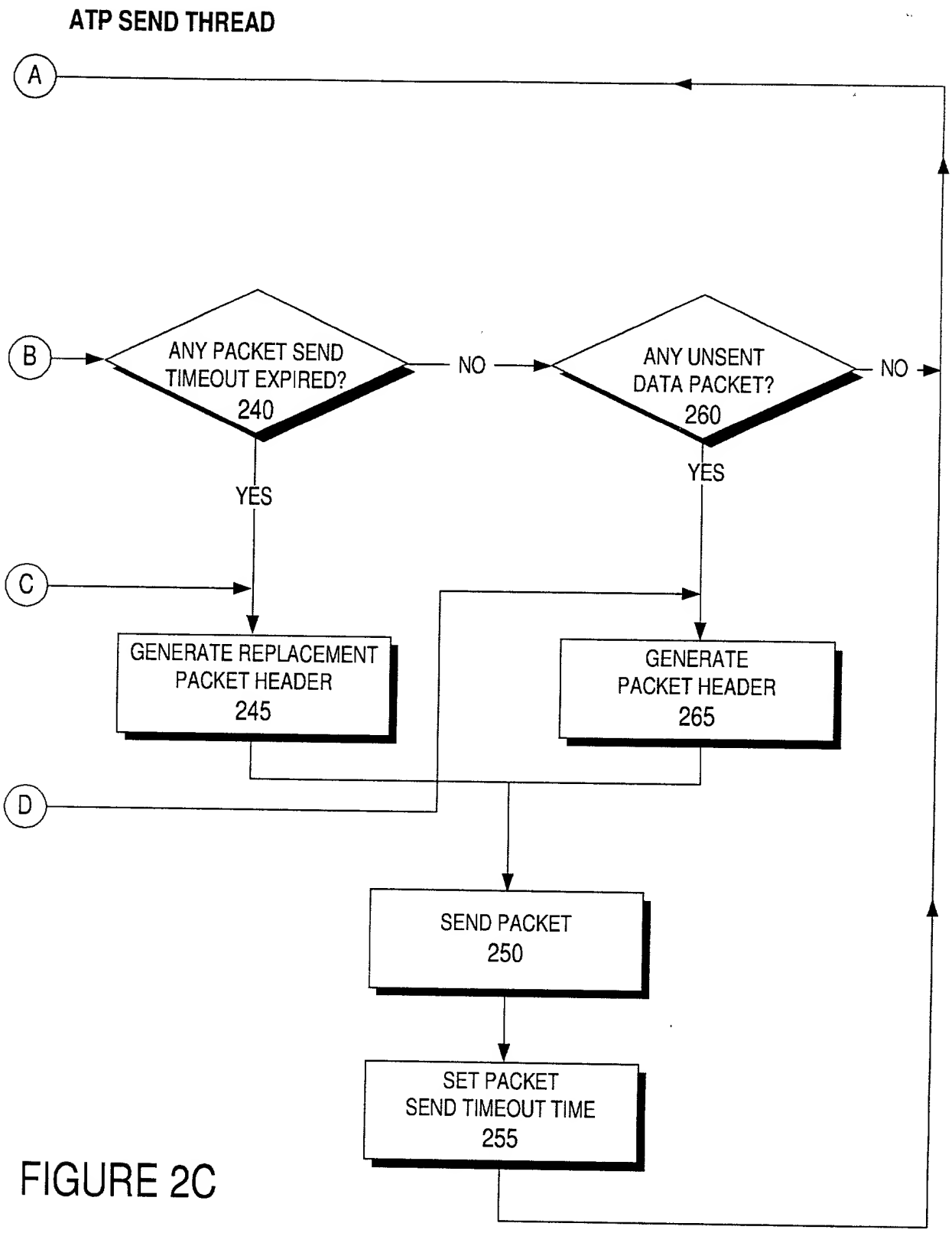
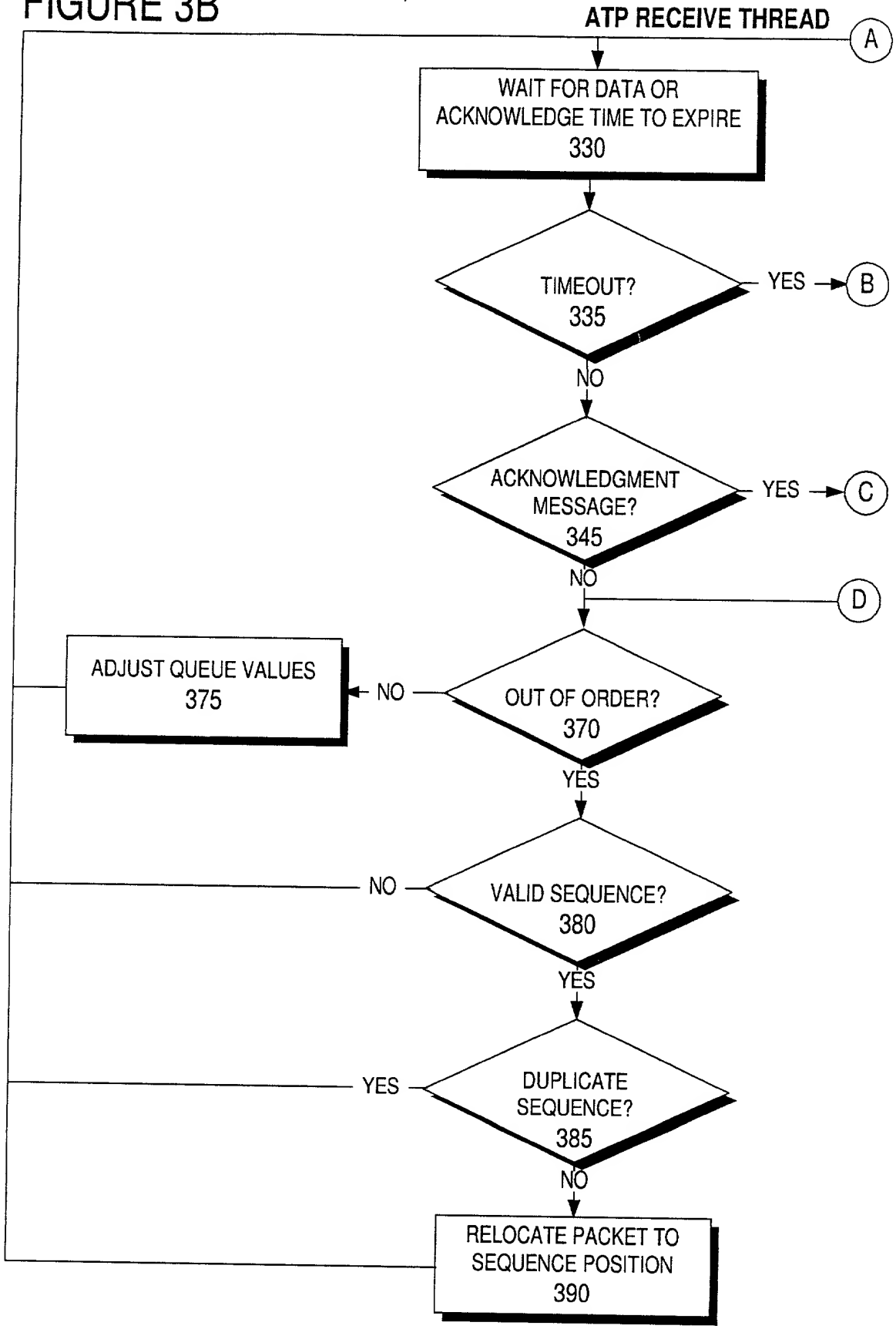

ATP SEND THREAD
A
B
ANY PACKET SEND TIMEOUT EXPIRED?
240
NO
ANY UNSENT DATA PACKET?
260
NO
YES
YES
C
GENERATE REPLACEMENT PACKET HEADER
245
GENERATE PACKET HEADER
265
D
SEND PACKET
250
SET PACKET SEND TIMEOUT TIME
255

FIGURE 2C

APPLICATION RECEIVE THREAD
REQUEST DATA BUFFER
300
PUT DATA FROM RECEIVE QUEUE INTO BUFFER
310
RETURN COUNT OF DATA PROVIDED
320

FIGURE 3A

FIGURE 3B


ATP RECEIVE THREAD
A
WAIT FOR DATA OR ACKNOWLEDGE TIME TO EXPIRE
330
TIMEOUT?
335
YES
B
NO
ACKNOWLEDGMENT MESSAGE?
345
YES
C
NO
D
ADJUST QUEUE VALUES
375
NO
OUT OF ORDER?
370
YES
NO
VALID SEQUENCE?
380
YES
YES
DUPLICATE SEQUENCE?
385
NO
RELOCATE PACKET TO SEQUENCE POSITION
390

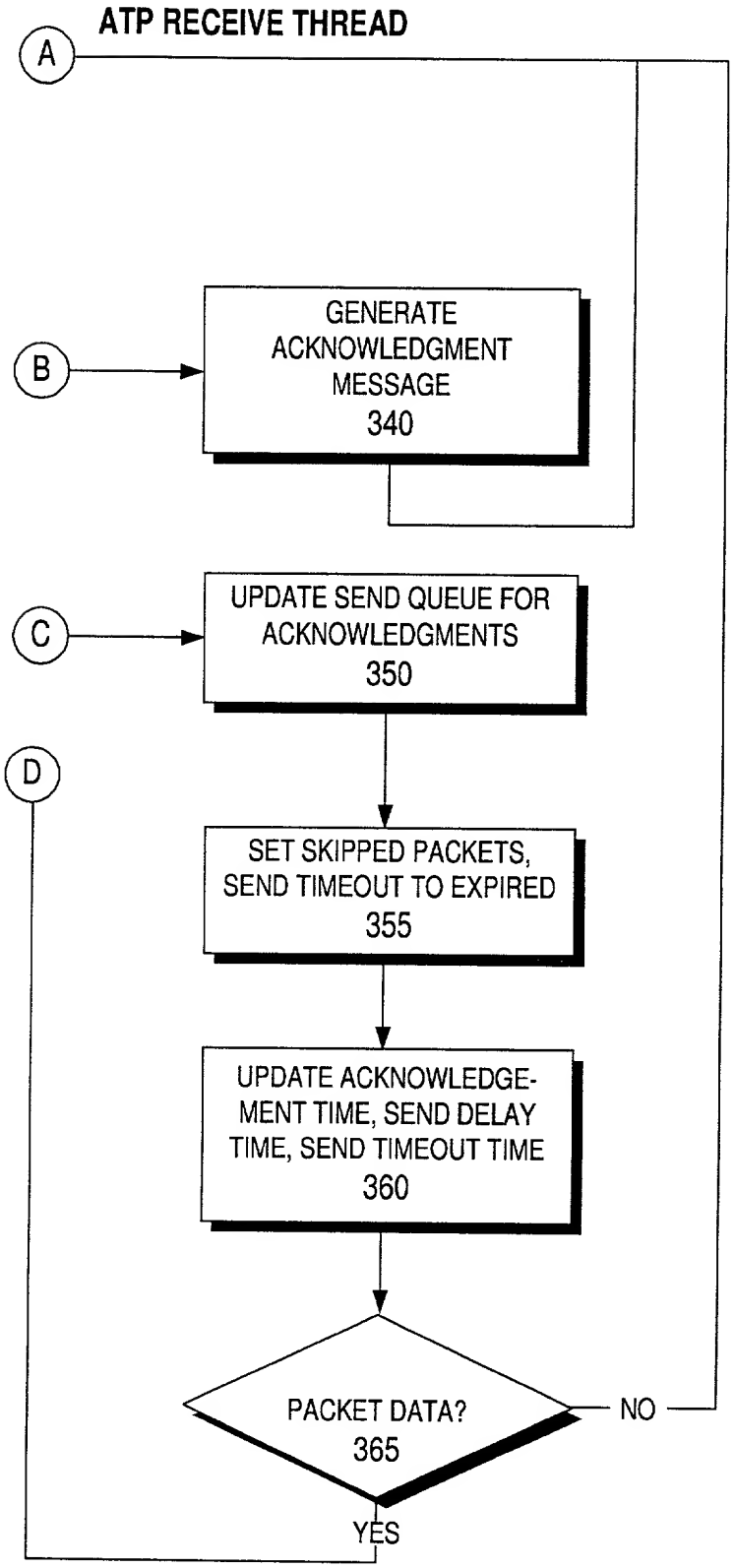

ATP RECEIVE THREAD
A
B
GENERATE ACKNOWLEDGMENT MESSAGE 340
C
UPDATE SEND QUEUE FOR ACKNOWLEDGMENTS 350
D
SET SKIPPED PACKETS, SEND TIMEOUT TO EXPIRED 355
UPDATE ACKNOWLEDGE-MENT TIME, SEND DELAY TIME, SEND TIMEOUT TIME 360
PACKET DATA? 365
NO
YES

FIGURE 3C

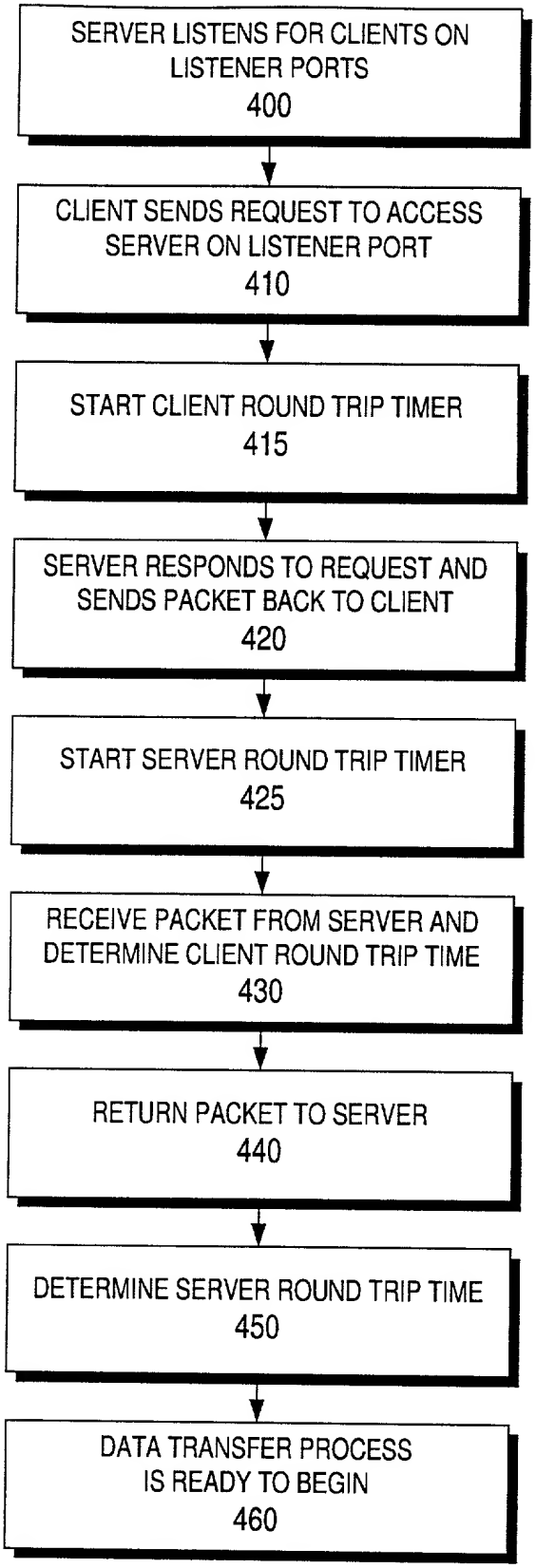

SERVER LISTENS FOR CLIENTS ON LISTENER PORTS
400
CLIENT SENDS REQUEST TO ACCESS SERVER ON LISTENER PORT
410
START CLIENT ROUND TRIP TIMER
415
SERVER RESPONDS TO REQUEST AND SENDS PACKET BACK TO CLIENT
420
START SERVER ROUND TRIP TIMER
425
RECEIVE PACKET FROM SERVER AND DETERMINE CLIENT ROUND TRIP TIME
430
RETURN PACKET TO SERVER
440
DETERMINE SERVER ROUND TRIP TIME
450
DATA TRANSFER PROCESS IS READY TO BEGIN
460

FIGURE 4

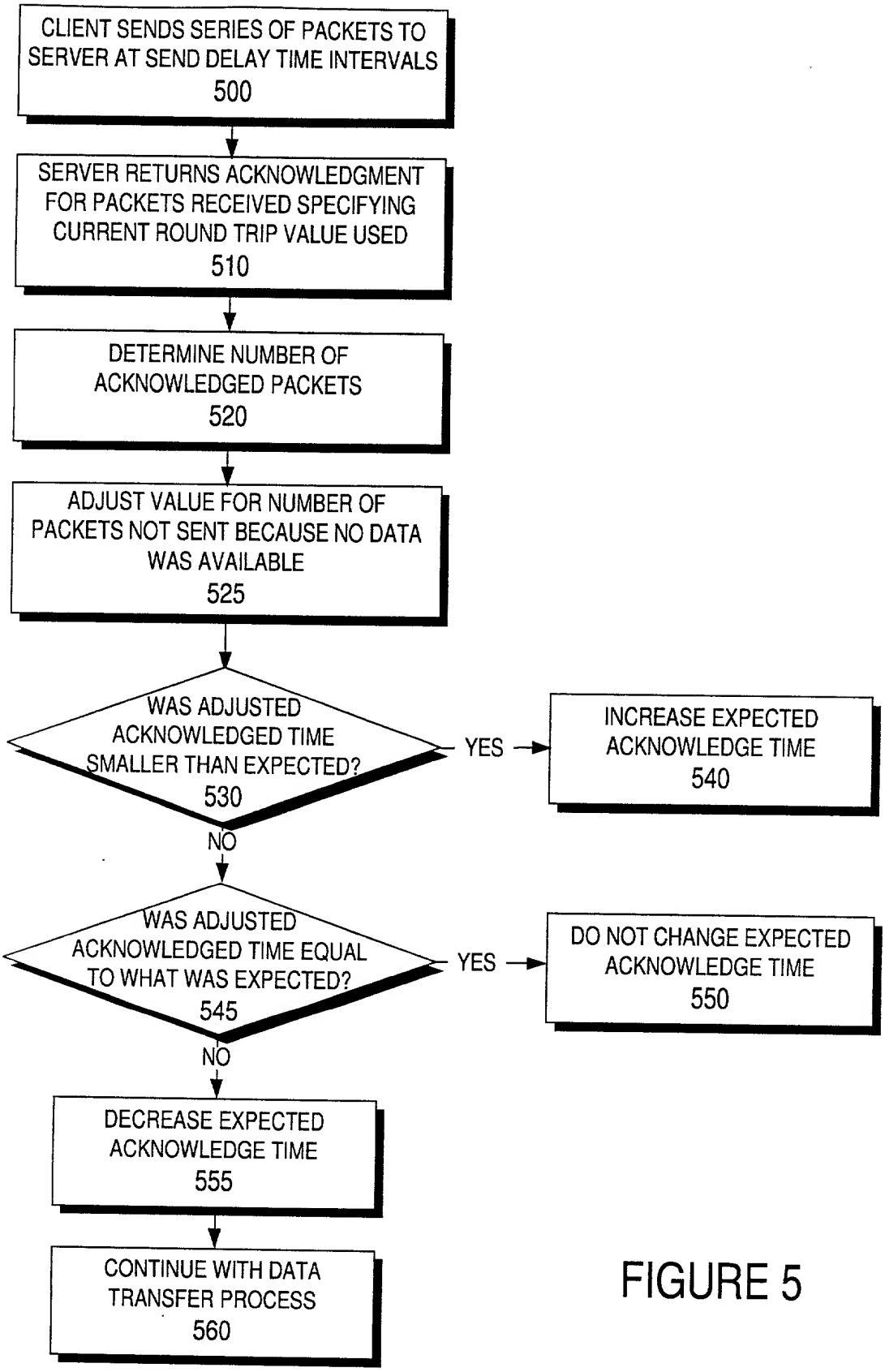

CLIENT SENDS SERIES OF PACKETS TO SERVER AT SEND DELAY TIME INTERVALS
500
SERVER RETURNS ACKNOWLEDGMENT FOR PACKETS RECEIVED SPECIFYING CURRENT ROUND TRIP VALUE USED
510
DETERMINE NUMBER OF ACKNOWLEDGED PACKETS
520
ADJUST VALUE FOR NUMBER OF PACKETS NOT SENT BECAUSE NO DATA WAS AVAILABLE
525
WAS ADJUSTED ACKNOWLEDGED TIME SMALLER THAN EXPECTED?
530
YES
INCREASE EXPECTED ACKNOWLEDGE TIME
540
NO
WAS ADJUSTED ACKNOWLEDGED TIME EQUAL TO WHAT WAS EXPECTED?
545
YES
DO NOT CHANGE EXPECTED ACKNOWLEDGE TIME
550
NO
DECREASE EXPECTED ACKNOWLEDGE TIME
555
CONTINUE WITH DATA TRANSFER PROCESS
560

FIGURE 5

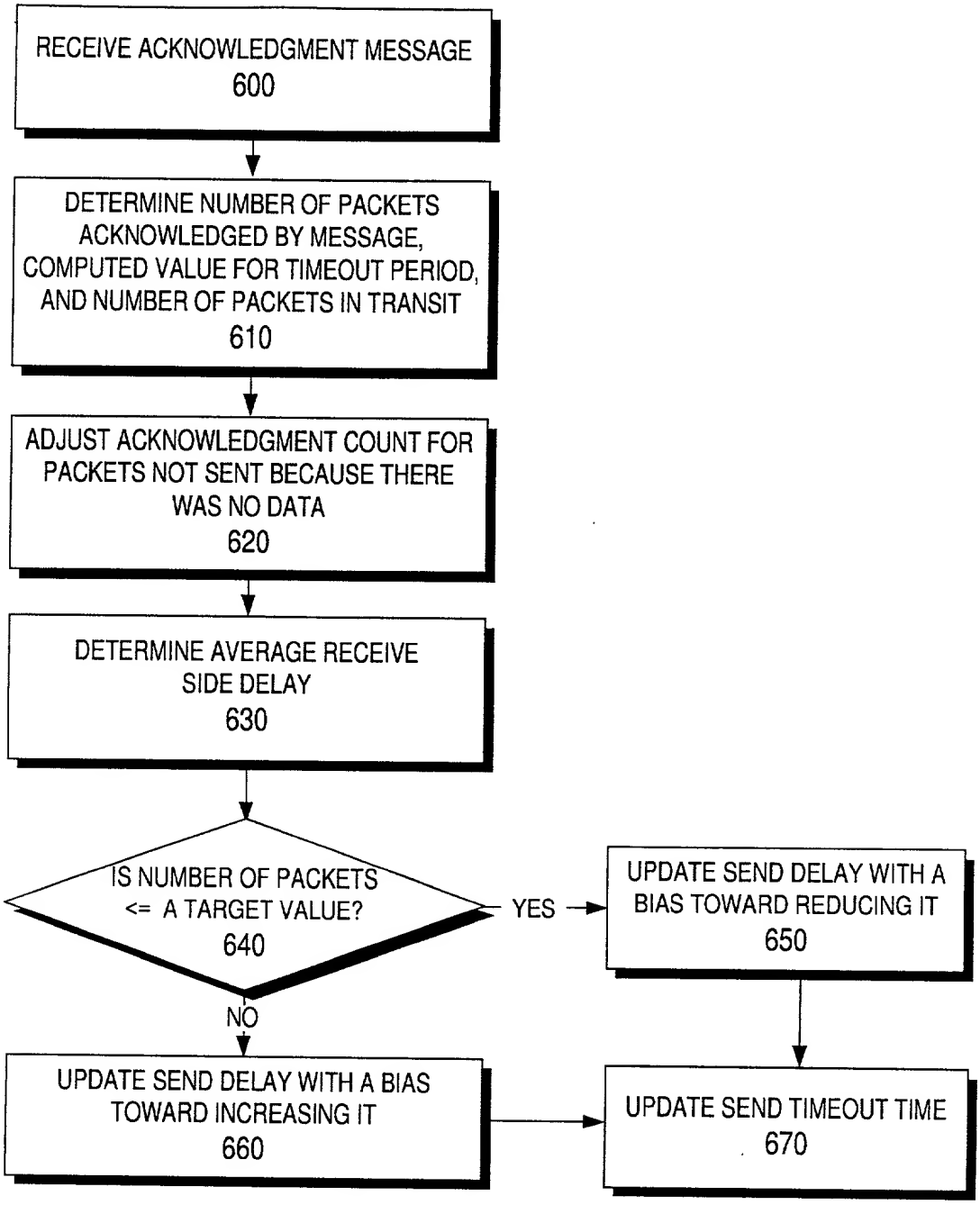

RECEIVE ACKNOWLEDGMENT MESSAGE
600
DETERMINE NUMBER OF PACKETS ACKNOWLEDGED BY MESSAGE, COMPUTED VALUE FOR TIMEOUT PERIOD, AND NUMBER OF PACKETS IN TRANSIT
610
ADJUST ACKNOWLEDGMENT COUNT FOR PACKETS NOT SENT BECAUSE THERE WAS NO DATA
620
DETERMINE AVERAGE RECEIVE SIDE DELAY
630
IS NUMBER OF PACKETS <= A TARGET VALUE?
640
YES
UPDATE SEND DELAY WITH A BIAS TOWARD REDUCING IT
650
NO
UPDATE SEND DELAY WITH A BIAS TOWARD INCREASING IT
660
UPDATE SEND TIMEOUT TIME
670

FIGURE 6

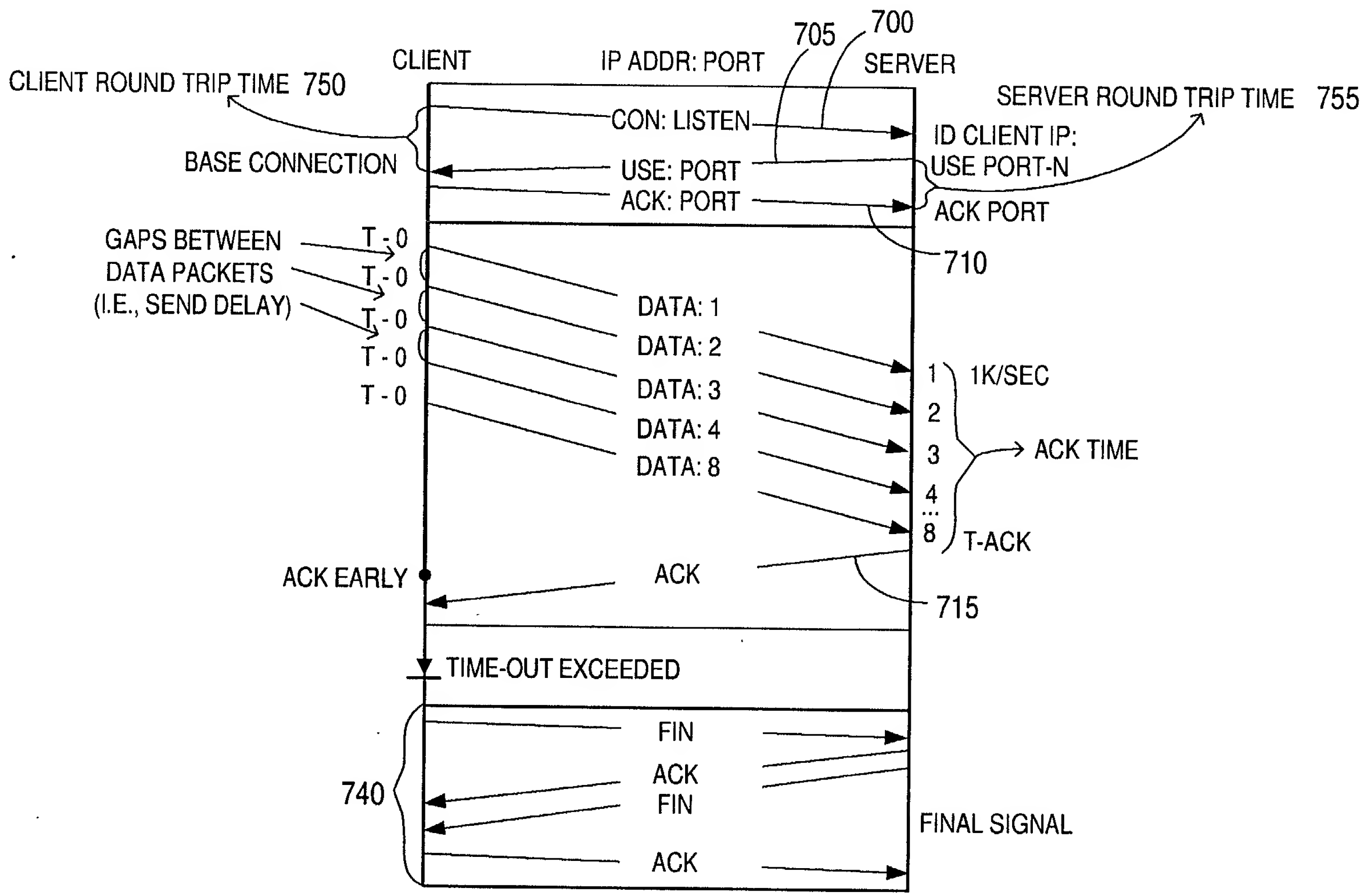

CLIENT
IP ADDR: PORT
SERVER
705
700
CLIENT ROUND TRIP TIME 750
BASE CONNECTION
CON: LISTEN
USE: PORT
ACK: PORT
SERVER ROUND TRIP TIME 755
ID CLIENT IP:
USE PORT-N
ACK PORT
710
GAPS BETWEEN
DATA PACKETS
(I.E., SEND DELAY)
T - 0
T - 0
T - 0
T - 0
T - 0
DATA: 1
DATA: 2
DATA: 3
DATA: 4
DATA: 8
1
2
3
4
8
1K/SEC
ACK TIME
T-ACK
ACK EARLY
ACK
715
TIME-OUT EXCEEDED
740
FIN
ACK
FIN
ACK
FINAL SIGNAL

FIGURE 7

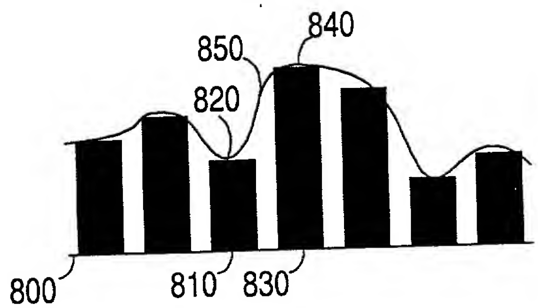


FIGURE 8

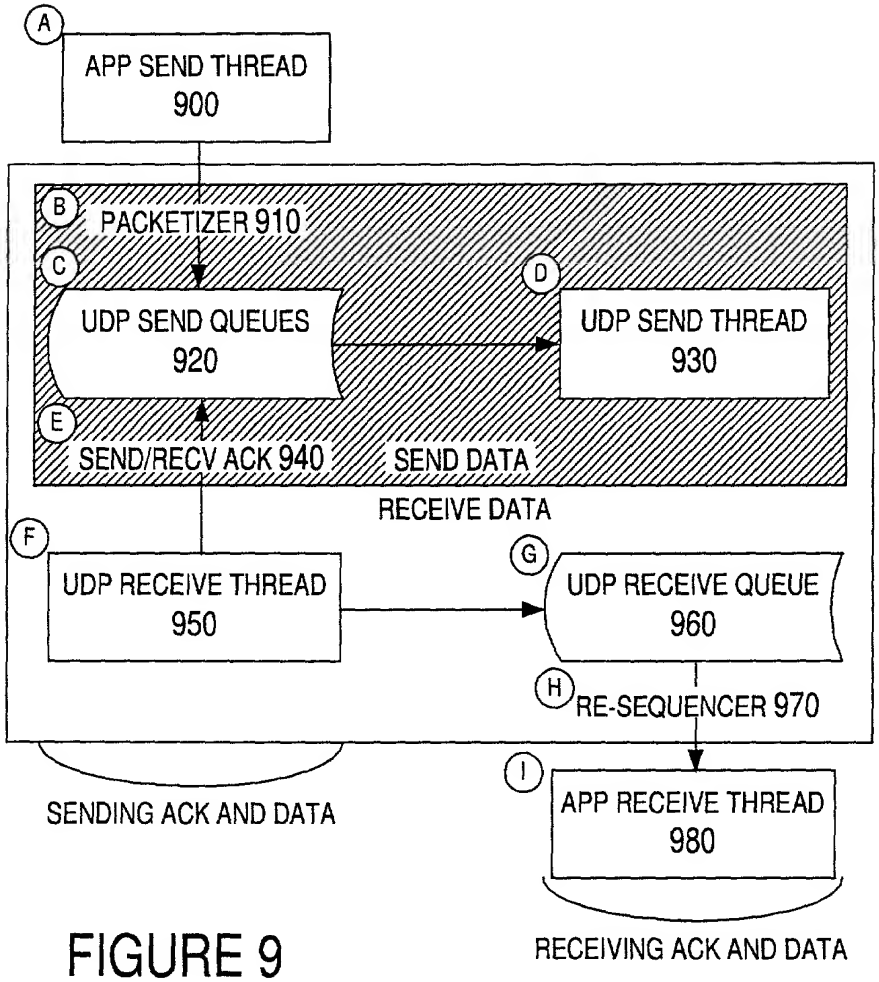

A
APP SEND THREAD
900
B
PACKETIZER 910
C
UDP SEND QUEUES
920
D
UDP SEND THREAD
930
E
SEND/RECV ACK 940
SEND DATA
RECEIVE DATA
F
UDP RECEIVE THREAD
950
G
UDP RECEIVE QUEUE
960
H
RE-SEQUENCER 970
I
APP RECEIVE THREAD
980
SENDING ACK AND DATA
RECEIVING ACK AND DATA

FIGURE 9

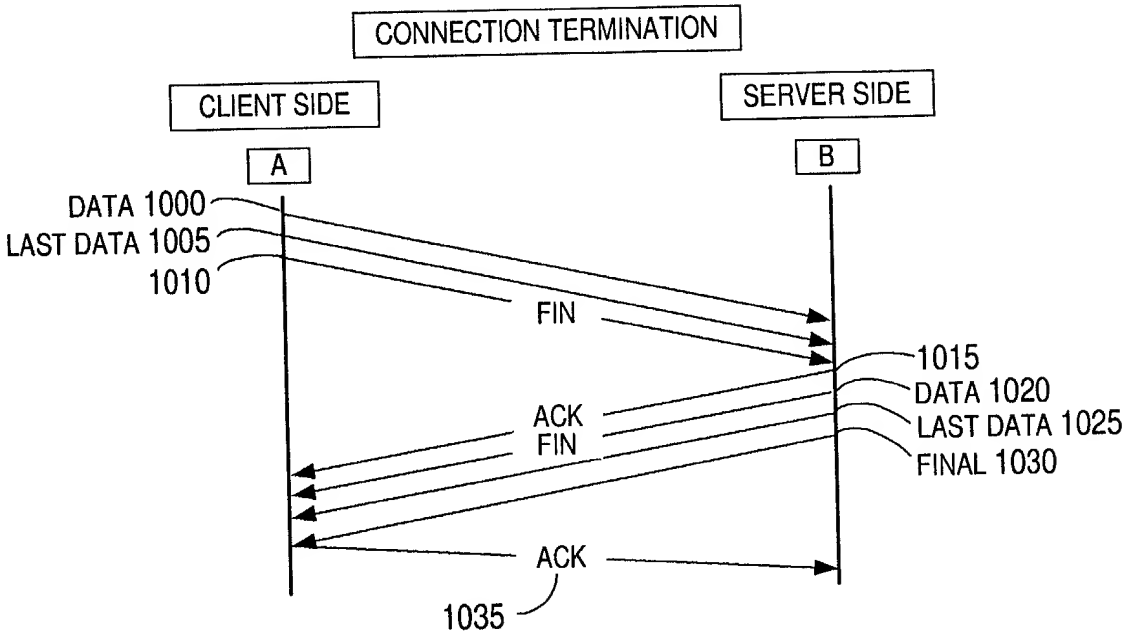


FIGURE 10

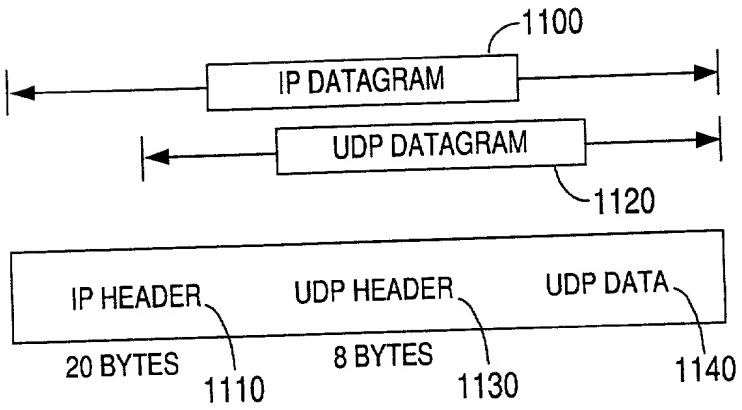

1100
IP DATAGRAM
UDP DATAGRAM
1120
IP HEADER
UDP HEADER
UDP DATA
20 BYTES
1110
8 BYTES
1130
1140

FIGURE 11

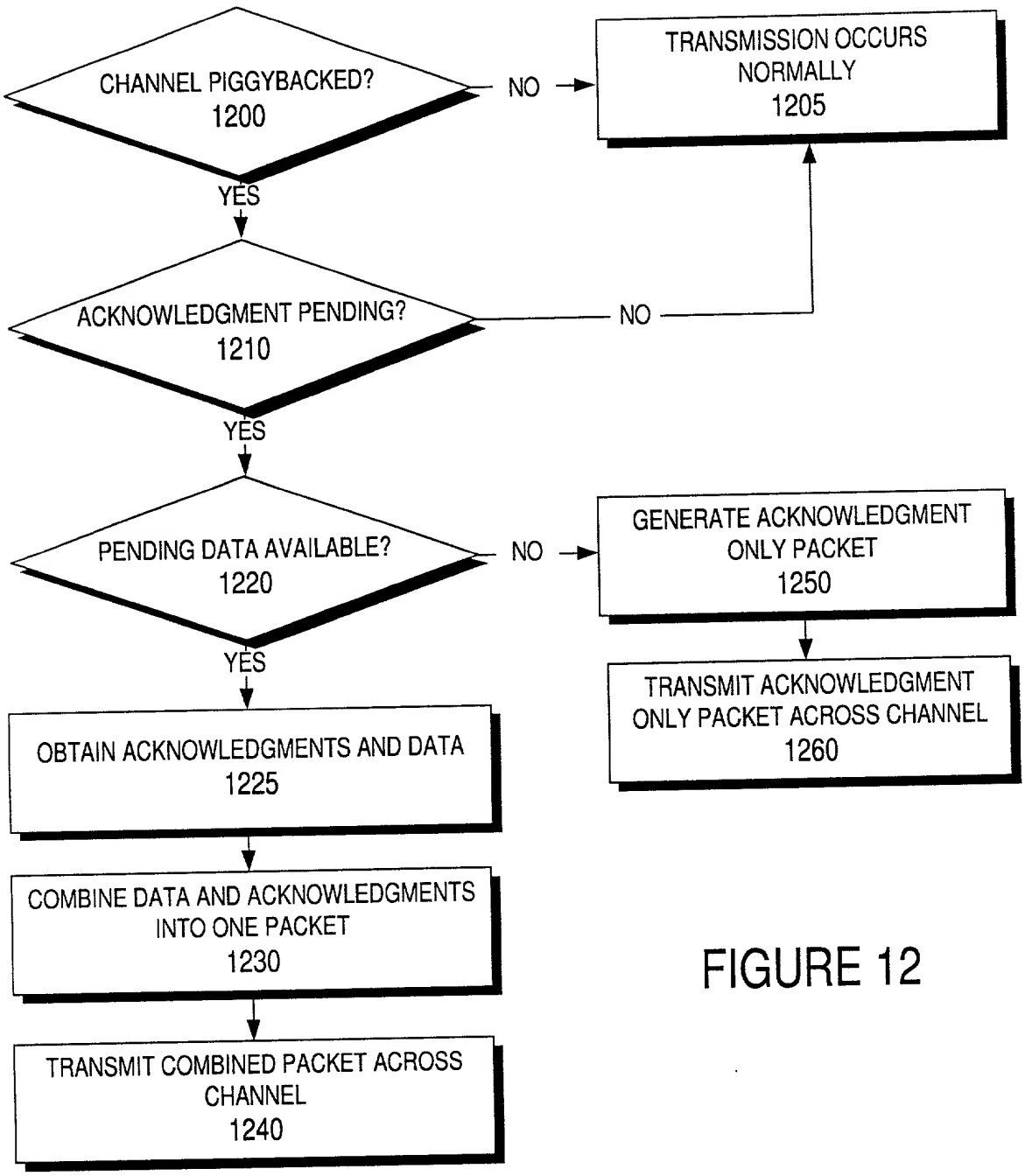

CHANNEL PIGGYBACKED?
1200
NO
TRANSMISSION OCCURS NORMALLY
1205
YES
ACKNOWLEDGMENT PENDING?
1210
NO
YES
PENDING DATA AVAILABLE?
1220
NO
GENERATE ACKNOWLEDGMENT ONLY PACKET
1250
YES
TRANSMIT ACKNOWLEDGMENT ONLY PACKET ACROSS CHANNEL
1260
OBTAIN ACKNOWLEDGMENTS AND DATA
1225
COMBINE DATA AND ACKNOWLEDGMENTS INTO ONE PACKET
1230
TRANSMIT COMBINED PACKET ACROSS CHANNEL
1240

FIGURE 12

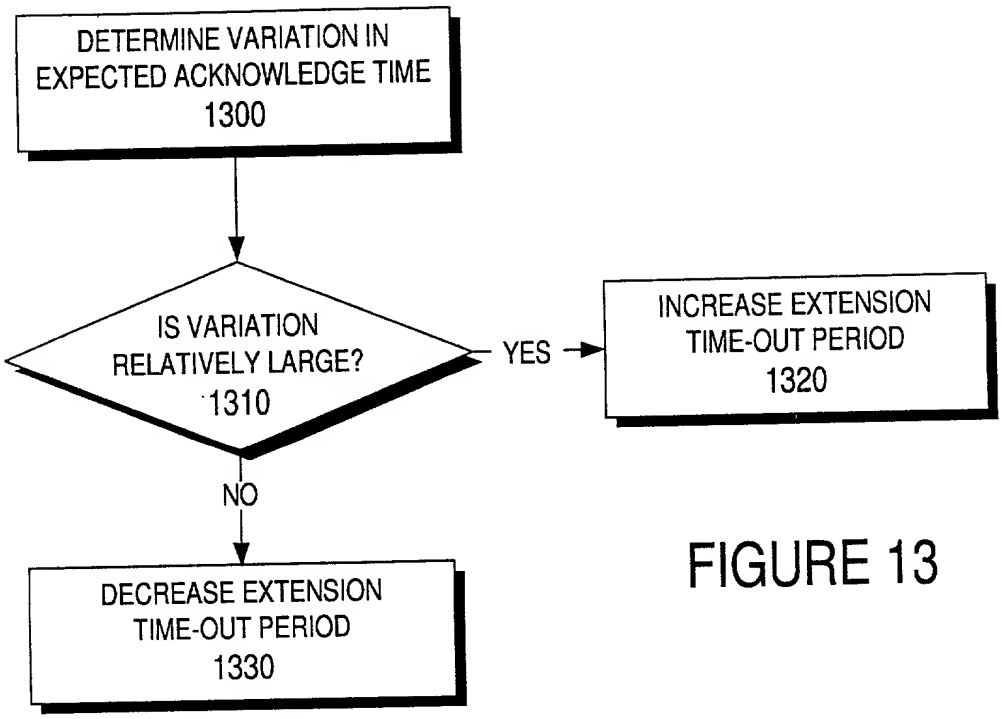

DETERMINE VARIATION IN EXPECTED ACKNOWLEDGE TIME
1300
IS VARIATION RELATIVELY LARGE?
1310
YES
INCREASE EXTENSION TIME-OUT PERIOD
1320
NO
DECREASE EXTENSION TIME-OUT PERIOD
1330

FIGURE 13

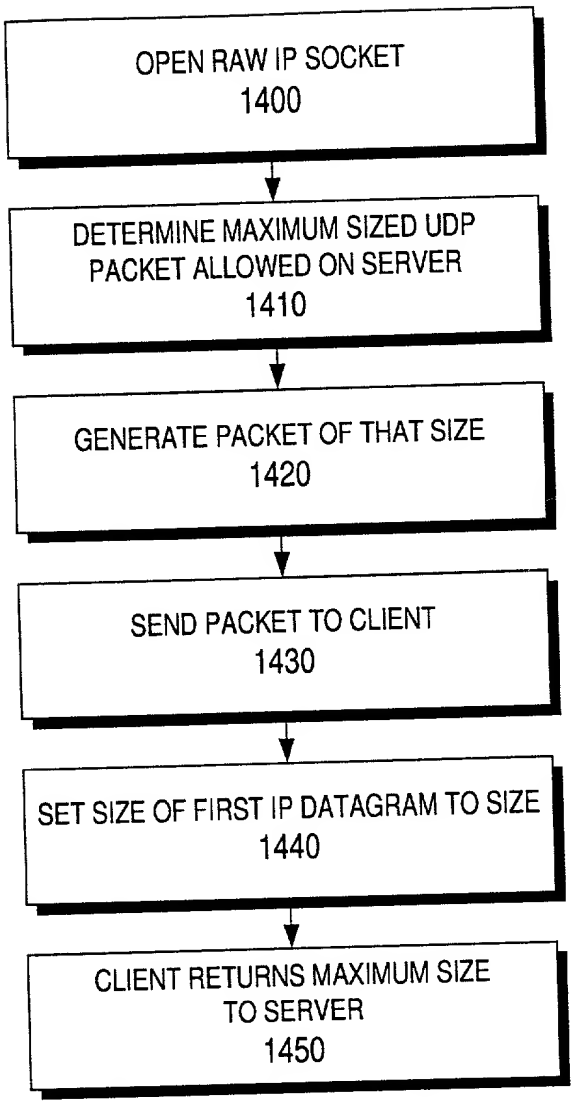

OPEN RAW IP SOCKET
1400
DETERMINE MAXIMUM SIZED UDP PACKET ALLOWED ON SERVER
1410
GENERATE PACKET OF THAT SIZE
1420
SEND PACKET TO CLIENT
1430
SET SIZE OF FIRST IP DATAGRAM TO SIZE
1440
CLIENT RETURNS MAXIMUM SIZE TO SERVER
1450

FIGURE 14

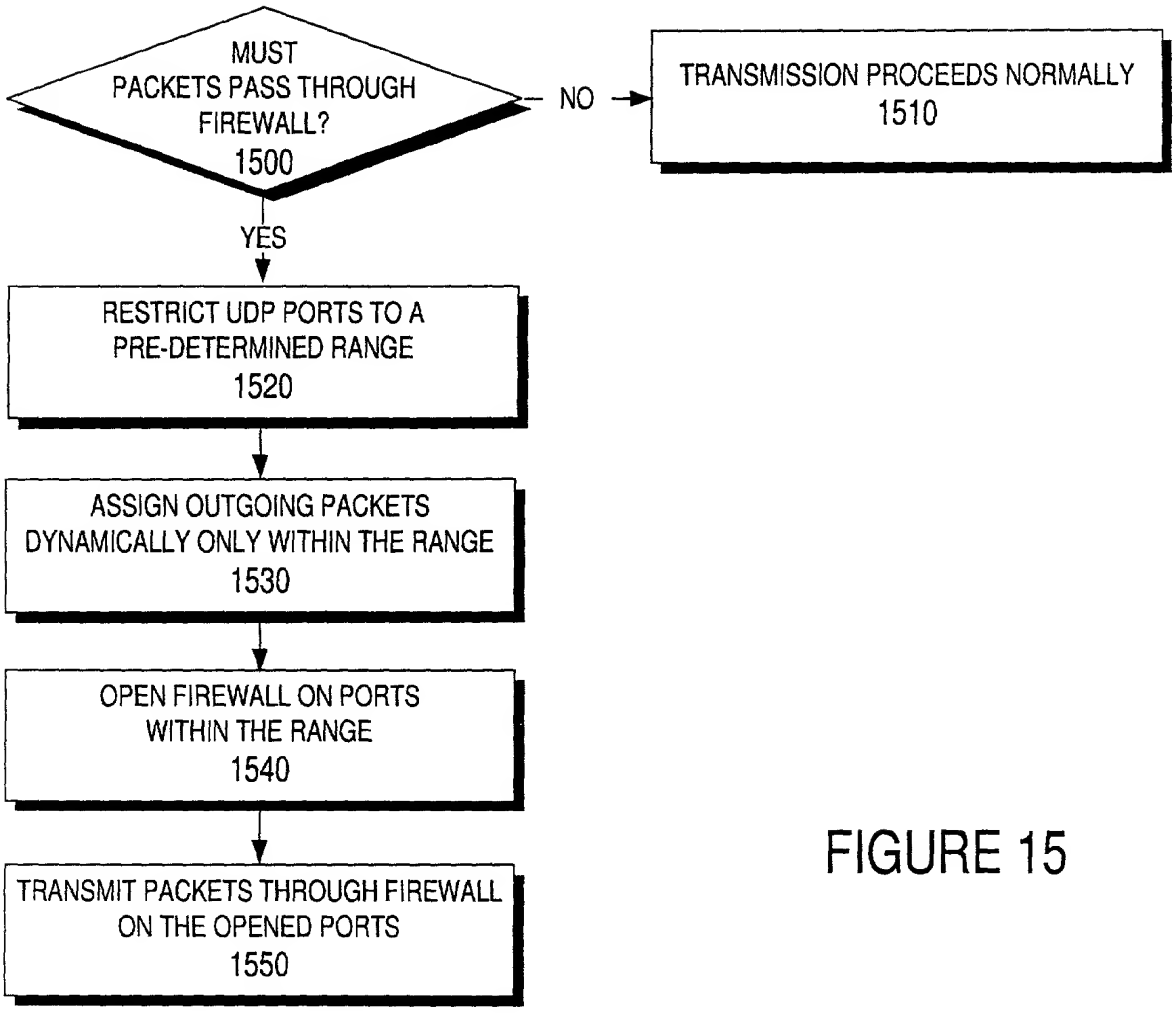

MUST
PACKETS PASS THROUGH
FIREWALL?
1500
NO
TRANSMISSION PROCEEDS NORMALLY
1510
YES
RESTRICT UDP PORTS TO A
PRE-DETERMINED RANGE
1520
ASSIGN OUTGOING PACKETS
DYNAMICALLY ONLY WITHIN THE RANGE
1530
OPEN FIREWALL ON PORTS
WITHIN THE RANGE
1540
TRANSMIT PACKETS THROUGH FIREWALL
ON THE OPENED PORTS
1550

FIGURE 15

<table>
<tr><td>VERSION</td><td>IHL</td><td>TOS</td><td colspan="2">LENGTH</td></tr>
<tr><td colspan="3">IDENTIFICATION</td><td>FLAGS</td><td>FRAGMENT OFFSET</td></tr>
<tr><td colspan="2">TIME TO LIVE</td><td>PROTOCOL</td><td colspan="2">CHECKSUM</td></tr>
<tr><td colspan="5">SOURCE IP ADDRESS</td></tr>
<tr><td colspan="5">DESTINATION IP ADDRESS</td></tr>
</table>

FIGURE 16

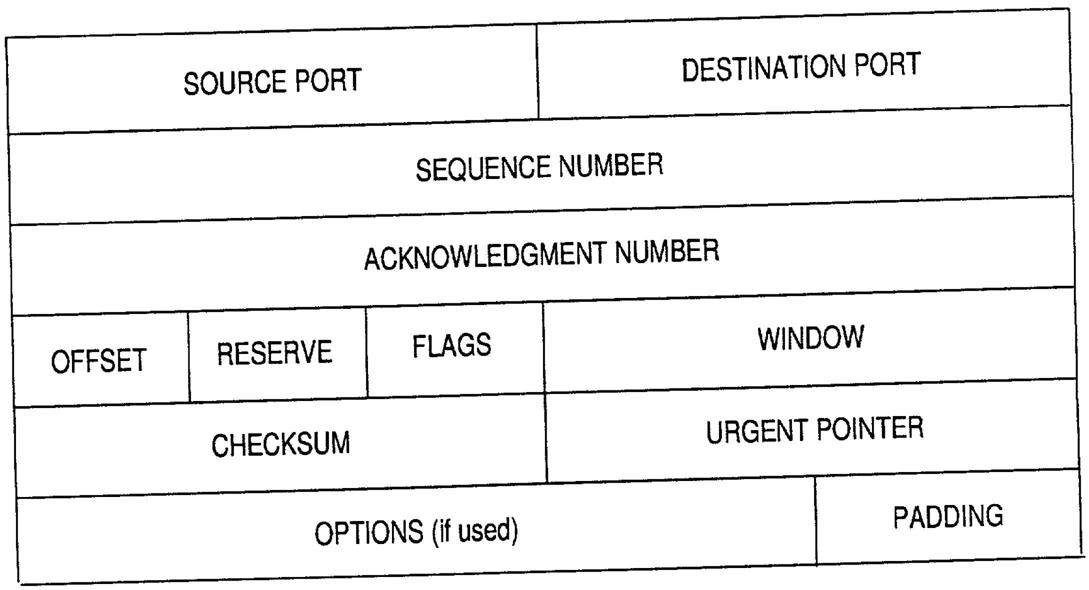

SOURCE PORT
DESTINATION PORT
SEQUENCE NUMBER
ACKNOWLEDGMENT NUMBER
OFFSET
RESERVE
FLAGS
WINDOW
CHECKSUM
URGENT POINTER
OPTIONS (if used)
PADDING

FIGURE 17